Unit 1 – Answers (odd)

Chapter 1.1

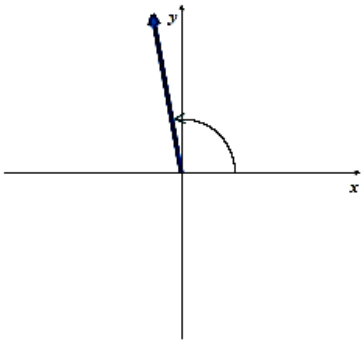
1. $63^\circ 45'$

3. $-317^\circ 3' 36''$

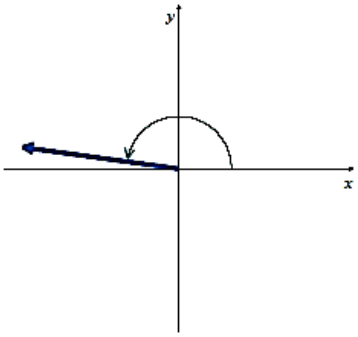
5. 125.833°

7. 502.583°

9.



11.



13. 79.509°

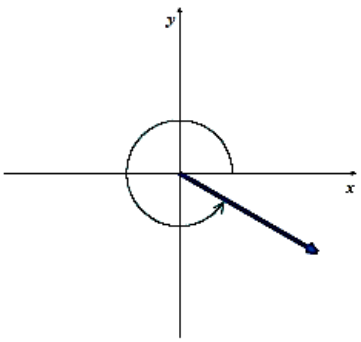
15. $7^\circ 54' 57''$

17. 79.509°

19. $62^\circ 54' 57''$

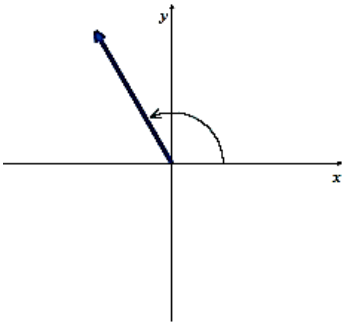
21. Quadrant IV angle

coterminal $480^\circ,\ -240^\circ$



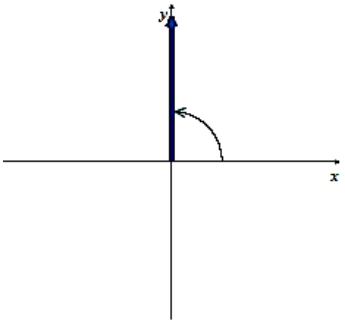
23. Quadrant II angle

coterminal $480^\circ,\ -240^\circ$



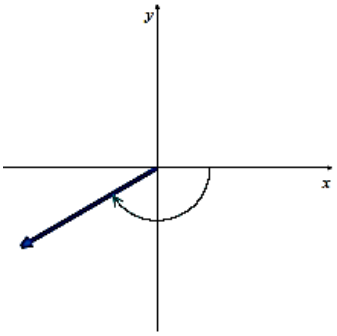
25. Lies on the positive y-axis

coterminal $90^\circ,\ -630^\circ$



27. Quadrant III angle

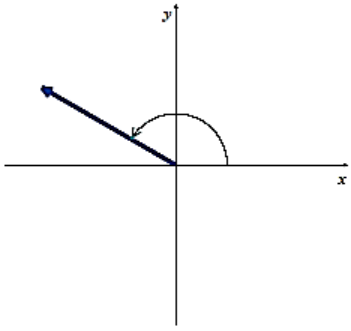
coterminal $210^\circ,\ -510^\circ$



Chapter 1.2

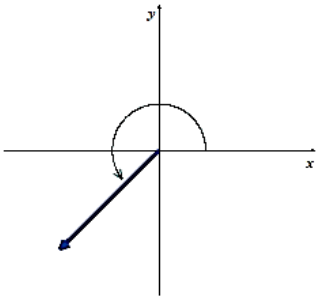
1. Quadrant II angle

coterminal $\frac{17\pi}{6},\ -\frac{7\pi}{6}$



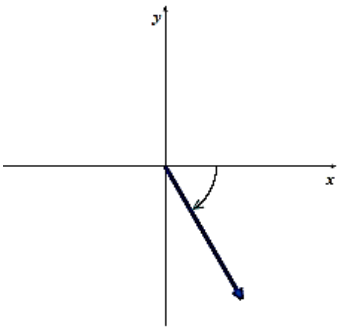
3. Quadrant III angle

coterminal $\frac{13\pi}{4},\ -\frac{3\pi}{4}$



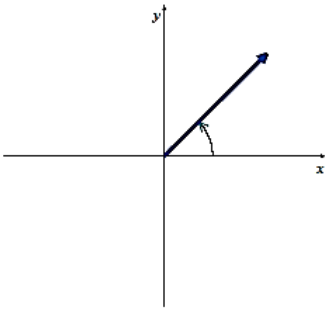
5. Quadrant IV angle

coterminal $\frac{5\pi}{3},\ -\frac{7\pi}{3}$



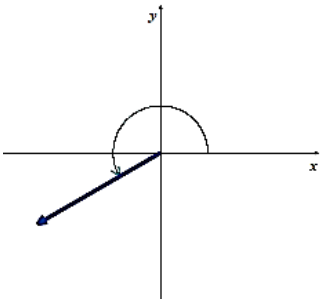
7. Quadrant I angle

coterminal $\frac{9\pi}{4},\ -\frac{7\pi}{4}$

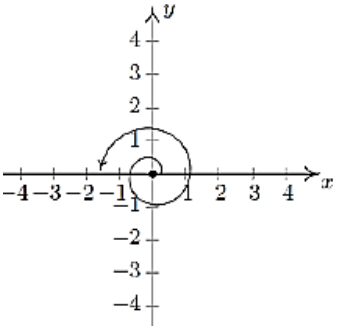


9. Quadrant III angle

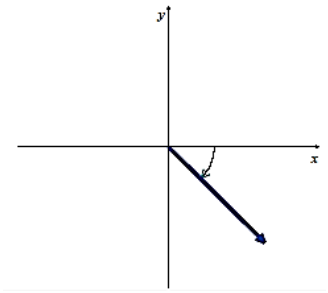
coterminal $\frac{19\pi}{6},\ -\frac{5\pi}{6}$



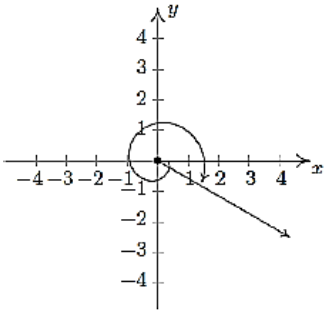
11. lies on negative x-axis
coterminal $\pi,\ -\pi$



13. Quadrant IV angle
coterminal $\frac{7\pi}{4},\ -\frac{9\pi}{4}$



15. Quadrant IV angle
coterminal $\frac{11\pi}{6},\ -\frac{\pi}{6}$



17. $\frac{4\pi}{3}$

19. $-\frac{3\pi}{2}$

21. $\frac{5\pi}{6}$

23. $-\frac{5\pi}{4}$

25. 120°

27. 330°

29. 300°

31. 90°

Chapter 1.3

1. $\approx 9.42\,in$

3. $\approx 18.33\,m$

5. $\approx 19.20\,in$

7. $\approx 37.70\,units^2$

9. $\approx 249.07\,units^2$

11. $\approx 52.36\,units^2$

13. $\approx 30.12\,mph$

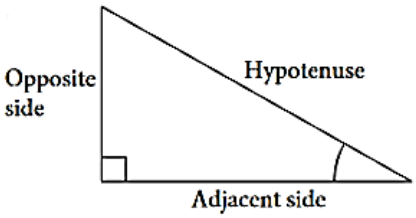
15. $\approx 3.33\,mph$

17. $\approx 4.32\,mph$

19. $24{,}000\pi,$
$\approx 75{,}398.22$ mm per min

Chapter 2.1

1.



3. The sum of two acute angles is a right triangle is $\frac{\pi}{2}$ radians, or 90°

5. $\sin(A)=\frac{5\sqrt{41}}{41},\cos(A)=\frac{4\sqrt{41}}{41},$
$\tan(A)=\frac{5}{4},\csc(A)=\frac{\sqrt{41}}{5},$
$\sec(A)=\frac{\sqrt{41}}{4},\cot(A)=\frac{4}{5}$

7. $\theta=60^\circ, b=\frac{\sqrt{3}}{3}, c=\frac{2\sqrt{3}}{3}$

9. $\beta=42^\circ, c=\frac{6}{\sin(48^\circ)}\approx 8.074,$
$a=\sqrt{c^2-6^2}\approx 5.402$

11. $\alpha=56^\circ, b=12\tan(34^\circ)\approx 8.094,$
$c=12\sec(34^\circ)=\frac{12}{\cos(34^\circ)}\approx 14.475$

13.
$\beta=40^\circ, b=2.5\tan(50^\circ)\approx 2.979,$
$c=2.5\sec(50^\circ)=\frac{2.5}{\cos(50^\circ)}\approx 3.889$

15. The side adjacent to θ has length
$5280\cos(78.123^\circ)\approx 1086.68$

17. The side opposite θ has length $10\sin(5^\circ)\approx 0.872$

19. The hypotenuse has length
$c=\frac{306}{\sin(37.5^\circ)}\approx 502.660,$ so the side adjacent to θ has length
$\sqrt{c^2-306^2}\approx 398.797$

21. The side opposite θ has length
$10\sin(15^\circ)\approx 2.588$

23. The hypotenuse has length
$14\csc(38.2^\circ)=\frac{14}{\sin(38.2^\circ)}\approx 22.639,$

25. The side opposite θ has length $31\tan(42^\circ)\approx 27.912$

27. $x\approx 188.3159$

29. $x\approx 188.5716$

31. The lights are about 75 feet apart.

33. The tree is about 41 feet tall.

35. The tower is about 682 feet tall. The guy wire hits the ground about 731 feet away from the base of the tower

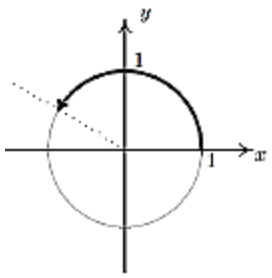
37. The ladder reaches approx. 22.65 feet up the side of the building.

39. The height of the building is approx. 368.76 feet.

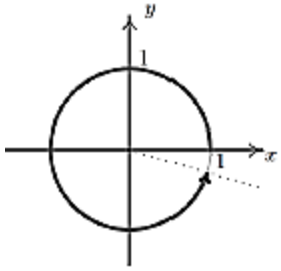
41. (Solution not provided.)

Chapter 2.2

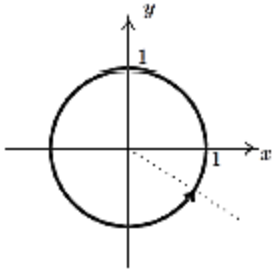
1.



3.



5.



7. Quadrant I

9. Quadrant IV

11. $\cos(0)=1,\ \sin(0)=0$

13. $\cos\left(\frac{\pi}{3}\right)=\frac{1}{2},\ \sin\left(\frac{\pi}{3}\right)=\frac{\sqrt{3}}{2}$

15.

$\cos\left(\frac{2\pi}{3}\right)=-\frac{1}{2},\ \sin\left(\frac{2\pi}{3}\right)=\frac{\sqrt{3}}{2}$

17. $\cos(\pi)=-1,\ \sin(\pi)=0$

19.

$\cos\left(\frac{5\pi}{4}\right)=-\frac{\sqrt{2}}{2},\ \sin\left(\frac{5\pi}{4}\right)=-\frac{\sqrt{2}}{2}$

21. $\cos\left(\frac{3\pi}{2}\right)=0,\ \sin\left(\frac{3\pi}{2}\right)=-1$

23.

$\cos\left(\frac{7\pi}{4}\right)=\frac{\sqrt{2}}{2},\ \sin\left(\frac{7\pi}{4}\right)=-\frac{\sqrt{2}}{2}$

25.

$\cos\left(-\frac{13\pi}{2}\right)=0,\ \sin\left(-\frac{13\pi}{2}\right)=-1$

27.

$\cos\left(-\frac{3\pi}{4}\right)=-\frac{\sqrt{2}}{2},\ \sin\left(-\frac{3\pi}{4}\right)=-\frac{\sqrt{2}}{2}$

29.

$\cos\left(\frac{10\pi}{3}\right)=-\frac{1}{2},\ \sin\left(\frac{10\pi}{3}\right)=-\frac{\sqrt{3}}{2}$

31. $\cos(\theta)=\frac{24}{25}$

33. $\cos(\theta)=-\frac{12}{13}$

35. $\cos(\theta)=-\frac{\sqrt{5}}{3}$

37. $\cos(\theta)=-\frac{\sqrt{5}}{5}$

39.

$\cos(\theta)=-\sqrt{0.8236}\approx -0.9075$

Chapter 2.3

1. $\tan\left(\frac{\pi}{4}\right)=1$

3. $\csc\left(\frac{5\pi}{6}\right)=2$

5. $\tan\left(-\frac{11\pi}{6}\right)=\frac{\sqrt{3}}{3}$

7. $\csc\left(-\frac{\pi}{3}\right)=-\frac{2\sqrt{3}}{3}$

9. $\tan(117\pi)=0$

11. $\csc(3\pi)$ is undefined

13. $\tan\left(\frac{31\pi}{2}\right)$ is undefined

15. $\csc\left(-\frac{7\pi}{4}\right)=\sqrt{2}$

17. $\tan\left(\frac{2\pi}{3}\right)=-\sqrt{3}$

19. $\csc\left(\frac{\pi}{2}\right)=1$

21.

$\sin(\theta)=\frac{1}{2}$ when $\theta=\frac{\pi}{6}+2\pi k$ or $\theta=\frac{5\pi}{6}+2\pi k$ for any integer k.

23. $\sin(\theta)=0$ when $\theta=\pi k$ for any integer k.

25.

$\sin(\theta)=\frac{\sqrt{3}}{2}$ when $\theta=\frac{\pi}{3}+2\pi k$ or $\theta=\frac{2\pi}{3}+2\pi k$ for any integer k.

27.

$\sin(\theta)=-1$ when $\theta=\frac{3\pi}{2}+2\pi k$ for any integer k.

29.

$\cos(\theta)=-1.001$ never happens.

31.

$\sec(\theta)=2$ when $\theta=\frac{\pi}{3}+2\pi k$ or $\theta=\frac{5\pi}{3}+2\pi k$ for any integer k.

33.

$\cot(\theta)=\frac{\sqrt{3}}{3}$ when $\theta=\frac{\pi}{3}+\pi k$ for any integer k.

35. $\sec(\theta)=1$ when $\theta=2\pi k$ for any integer k.

37. $\cot(\theta)=0$ when $\theta=\frac{\pi}{2}+\pi k$ for any integer k.

39. $\sec(\theta)=0$ never happens.

41. $\sec(\theta)=-1$ when $\theta=\pi+2\pi k=(2k+1)\pi$ for any integer k.

43.

$\csc(\theta) = -2$ when $\theta = \frac{7\pi}{6} + 2\pi k$ or

$\theta = \frac{11\pi}{6} + 2\pi k$ for any integer k.

45.

$\cos(t) = 0$ when $t = \frac{\pi}{2} + \pi k$ or

for any integer k.

47. $\cos(t) = 3$ never happens.

49.

$\cos(t) = \frac{1}{2}$ when $t = \frac{\pi}{3} + 2\pi k$ or

$\theta = \frac{5\pi}{3} + 2\pi k$ for any integer k.

51. $\cos(t) = 1$ when $t = 2\pi k$ or
for any integer k.

53.

$\cos(t) = -\frac{\sqrt{2}}{2}$ when $t = \frac{3\pi}{4} + 2\pi k$ or

$\theta = \frac{5\pi}{4} + 2\pi k$ for any integer k.

55. $\tan(t) = \frac{\sqrt{3}}{3}$ when $t = \frac{\pi}{6} + \pi k$
for any integer k.

57. $\csc(t) = 0$ never happens.

59.

$\tan(t) = -\frac{\sqrt{3}}{3}$ when $t = \frac{5\pi}{6} + \pi k$

for any integer k.

61.

$\csc(t) = \frac{2\sqrt{3}}{3}$ when $t = \frac{\pi}{3} + 2\pi k$ or

$\theta = \frac{2\pi}{3} + 2\pi k$ for any integer k.

63. (Solution not provided.)

Chapter 2.4

Solutions to these exercises are not provided. To verify each of the identities in these exercises, start with the expression on one side of the identity and apply the necessary steps to arrive at the expression on the other side of the identity. Most importantly, carefully show each step and ensure that it is the application of a trigonometric identity or mathematical property.

Chapter 2.5

1.

$\sin(A) = \frac{5\sqrt{26}}{26}$, $\cos(A) = \frac{\sqrt{26}}{26}$,

$\tan(A) = 5$, $\csc(A) = \frac{\sqrt{26}}{5}$,

$\sec(A) = \sqrt{26}$, $\cot(A) = \frac{1}{5}$

3.

$\sin(C) = -\frac{\sqrt{10}}{10}$, $\cos(C) = -\frac{3\sqrt{10}}{10}$,

$\tan(C) = \frac{1}{3}$, $\csc(C) = -\sqrt{10}$,

$\sec(C) = -\frac{\sqrt{10}}{3}$, $\cot(C) = 3$

5.

$\sin(P) = \frac{24}{25}$, $\cos(P) = -\frac{7}{25}$,

$\tan(P) = -\frac{24}{7}$, $\csc(P) = \frac{25}{24}$,

$\sec(P) = -\frac{25}{7}$, $\cot(P) = -\frac{7}{24}$

7.

$\sin(R) = -\frac{9\sqrt{106}}{106}$, $\cos(R) = \frac{5\sqrt{106}}{106}$,

$\tan(R) = -\frac{9}{5}$, $\csc(R) = -\frac{\sqrt{106}}{9}$,

$\sec(R) = \frac{\sqrt{106}}{5}$, $\cot(R) = -\frac{5}{9}$

9. Approximately 2249 miles

11. Using 33.87° South Latitude, radius is approximately 1705 miles.

13.

$r = 1.125\text{in.}\, w = 9000\pi \frac{\text{rad}}{\text{min}}$,

$x = 1.125\cos(9000\pi t)$

$y = 1.125\sin(9000\pi t)$.

Here *x* and *y* are measured in inches and *t* is measured in minutes.

15.

$r = 1.25\text{in.}\, w = 14400\pi \frac{\text{rad}}{\text{min}}$,

$x = 1.25\cos(14400\pi t)$,

$y = 1.25\sin(14400\pi t)$.

Here *x* and *y* are measured in inches and *t* is measured in minutes.

17.

$\sin(\theta) = \frac{3}{5}$, $\cos(\theta) = -\frac{4}{5}$,

$\tan(\theta) = -\frac{3}{4}$, $\csc(\theta) = \frac{5}{3}$,

$\sec(\theta) == -\frac{5}{4}$, $\cot(\theta) = -\frac{4}{3}$

19.

$\sin(\theta) = \frac{24}{25}$, $\cos(\theta) = \frac{7}{25}$,

$\tan(\theta) = \frac{24}{7}$, $\csc(\theta) = \frac{25}{24}$,

$\sec(\theta) == \frac{25}{7}$, $\cot(\theta) = \frac{7}{24}$

21.

$\sin(\theta) = -\frac{\sqrt{91}}{10}$, $\cos(\theta) = -\frac{3}{10}$,

$\tan(\theta) = \frac{\sqrt{91}}{3}$, $\csc(\theta) = -\frac{10\sqrt{91}}{91}$,

$\sec(\theta) == -\frac{10}{3}$, $\cot(\theta) = \frac{3\sqrt{91}}{91}$

23.

$\sin(\theta) = -\frac{2\sqrt{5}}{5}$, $\cos(\theta) = \frac{\sqrt{5}}{5}$,

$\tan(\theta) = -2$, $\csc(\theta) = -\frac{\sqrt{5}}{2}$,

$\sec(\theta) = \sqrt{5}$, $\cot(\theta) = -\frac{1}{2}$

25.

$\sin(\theta) = -\frac{\sqrt{6}}{6}, \cos(\theta) = -\frac{\sqrt{30}}{6},$

$\tan(\theta) = \frac{\sqrt{5}}{5}, \csc(\theta) = -\sqrt{6},$

$\sec(\theta) == -\frac{\sqrt{30}}{5}, \cot(\theta) = \sqrt{5}$

27.

$\sin(\theta) = \frac{\sqrt{5}}{5}, \cos(\theta) = \frac{2\sqrt{5}}{5},$

$\tan(\theta) = \frac{1}{2}, \csc(\theta) = \sqrt{5},$

$\sec(\theta) == \frac{\sqrt{5}}{2}, \cot(\theta) = 2$

29.

$\sin(\theta) = -\frac{\sqrt{110}}{11}, \cos(\theta) = -\frac{\sqrt{11}}{11},$

$\tan(\theta) = \sqrt{10}, \csc(\theta) = -\frac{\sqrt{110}}{10},$

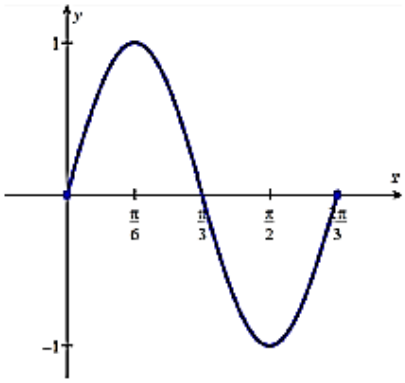
$\sec(\theta) = -\sqrt{11}, \cot(\theta) = \frac{\sqrt{10}}{10}$

31. (Solution not provided.)

Chapter 3.1

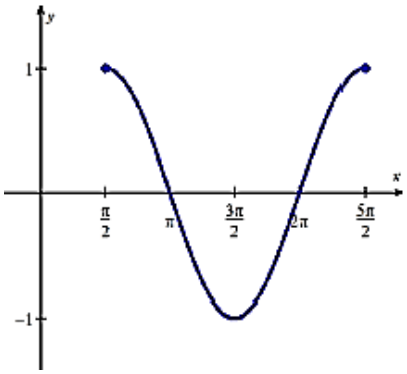
1. (Solution not provided.)
3. (Solution not provided.)

5. $y = \sin(3x)$ has period $\frac{2\pi}{3}$

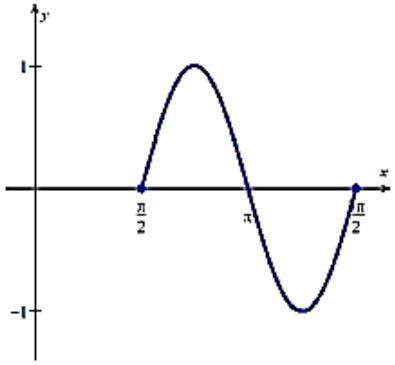


7.

$y = \cos\left(x - \frac{\pi}{2}\right)$ has period 2π

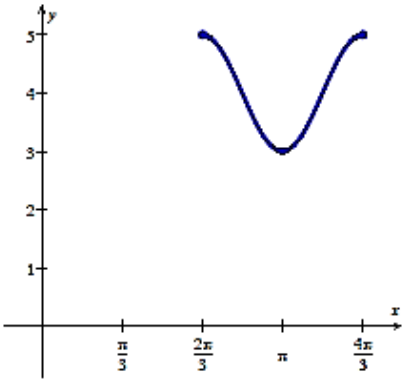


9. $y = \sin(2x - \pi)$ has period π



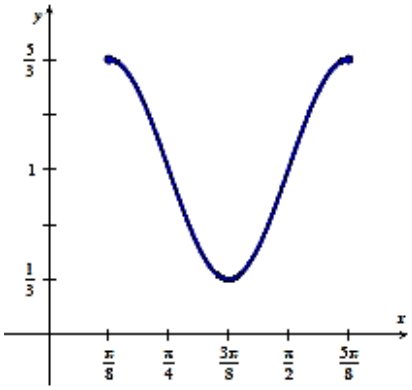
11.

$y = \cos(3x - 2\pi) + 4$ has period $\frac{2\pi}{3}$



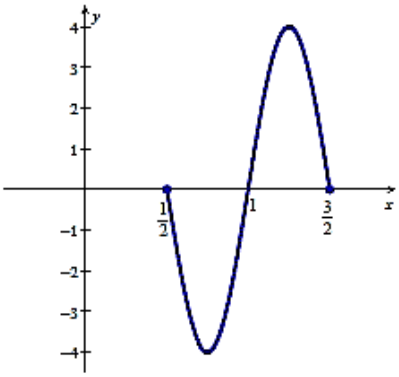
13.

$y = \frac{2}{3}\cos\left(\frac{\pi}{2} - 4x\right) + 1$ has period $\frac{\pi}{2}$

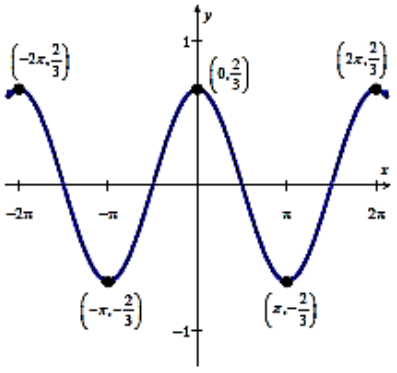


15.

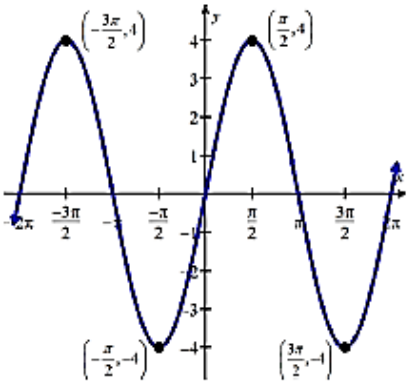
$y = 4\sin(-2\pi x + \pi)$ has period 1



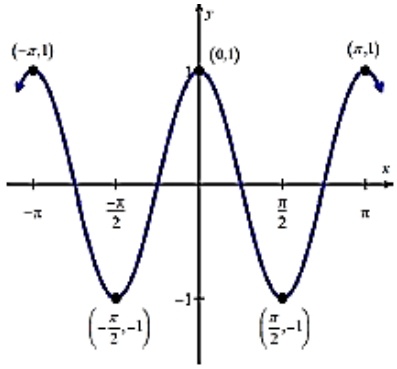
17. $y = \frac{2}{3}\cos(x)$ has period 2π



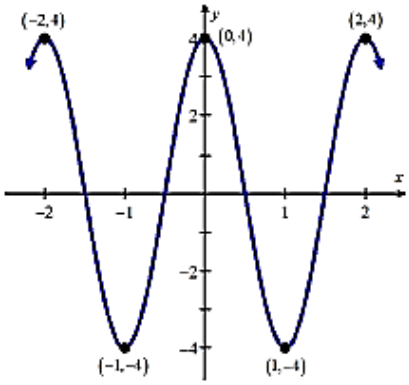
19. $y = 4\sin(x)$ has period 2π



21. $y = \cos(2x)$ has period π

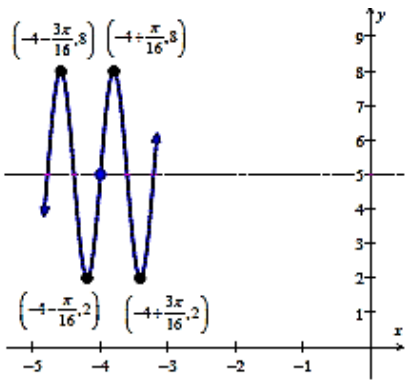


23. $y = 4\cos(\pi x)$ has period 2



25.

$y = 3\sin[8(x+4)]+5$ has period $\frac{\pi}{4}$

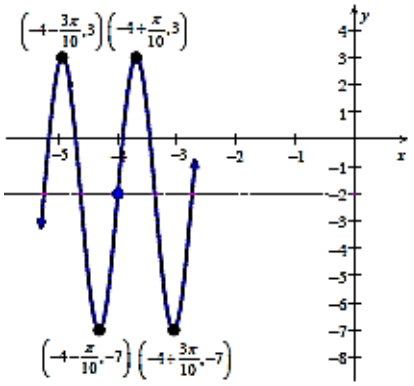


27.

$y = 5\sin(5x+20)-2$ has period $\frac{2\pi}{5}$

Chapter 3.2

1.



$y = 3\sin(x)$

Period: 2π

Amplitude: 3

Phase Shift: 0

Vertical Shift: 0

3.

$y = -2\cos(x)$

Period: 2π

Amplitude: 2

Phase Shift: 0

Vertical Shift: 0

5.

$y = -\sin\left(x+\frac{\pi}{3}\right)$

Period: 2π

Amplitude: 1

Phase Shift: $-\frac{\pi}{3}$

Vertical Shift: 0

7.

$y = -\frac{1}{3}\cos\left(\frac{1}{2}x+\frac{\pi}{3}\right)$

Period: 4π

Amplitude: $\frac{1}{3}$

Phase Shift: $-\frac{2\pi}{3}$

Vertical Shift: 0

9.

$y = \sin\left(-x-\frac{\pi}{4}\right)-2$

Period: 2π

Amplitude: 1

Phase Shift: $-\frac{\pi}{4}$

Vertical Shift: -2

11.

$y = -\frac{3}{2}\cos\left(2x+\frac{\pi}{3}\right)-\frac{1}{2}$

Period: π

Amplitude: $\frac{3}{2}$

Phase Shift: $-\frac{\pi}{6}$

Vertical Shift: $-\frac{1}{2}$

13. $S(x) = 2\sin\left(\frac{\pi}{2}x\right)-3$

15. $C(x) = -2\cos\left(\frac{2\pi}{5}x\right)+3$

17. $C(x) = -4\cos\left[\pi\left(x-\frac{\pi}{2}\right)\right]$

19. $C(x) = 2\cos(\pi x)+1$

21-25 (Solutions not provided.)

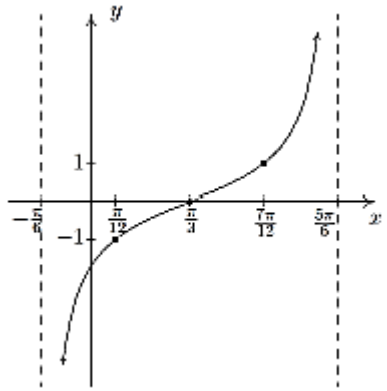
27. a. period: $\frac{\pi}{5}$, amplitude: 12.5, vertical shift: 13.5

b. $h(t) = -12.5\cos\left(\frac{\pi}{5}t\right)+13.5$

c. A person is 26 meters off the ground after 5 minutes.

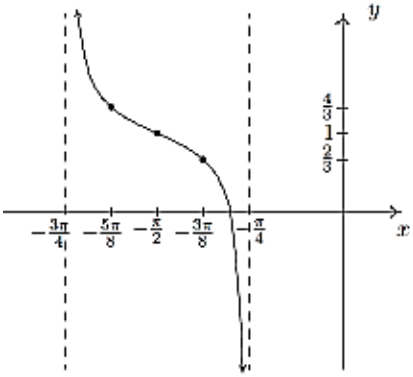
Chapter 3.3

1. $y = \tan\left(x - \frac{\pi}{3}\right)$ has period π



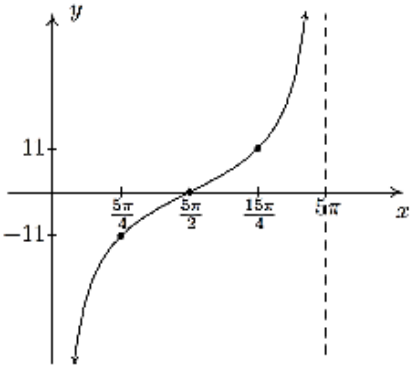
3.

$y = \frac{1}{3}\tan(-2x - \pi) + 1$ has period $\frac{\pi}{2}$



5.

$y = -11\cot\left(\frac{1}{5}x\right)$ has period 5π

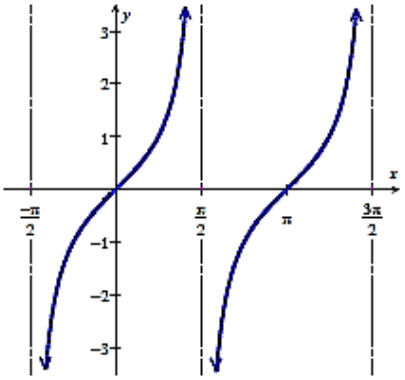


7.

$f(x) = \tan(x)$ has period π

asymptotes $x = \frac{\pi}{2} + k\pi,$

any integer k

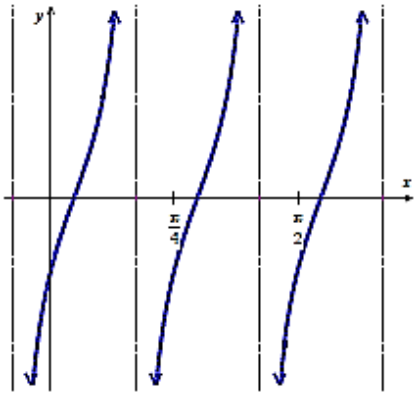


9.

$f(x) = 2\tan(4x - 32)$ has period $\frac{\pi}{4}$

asymptotes $x = \frac{1}{4}\left(\frac{\pi}{2} + k\pi\right) + 8,$

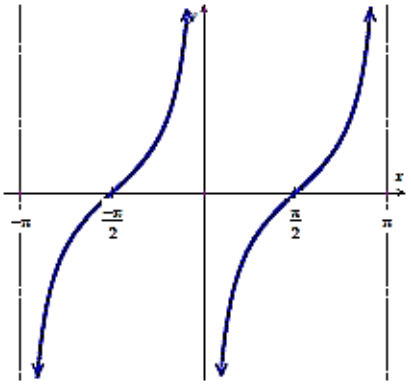
any integer k



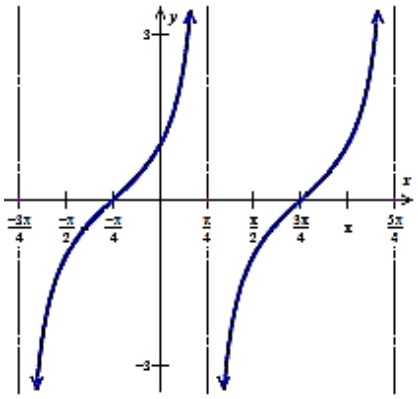
11.

$f(x) = \tan\left(x - \frac{\pi}{2}\right)$ has period π

asymptotes $x = \pi k,$ any integer k



13.



$f(x) = \tan\left(x + \frac{\pi}{4}\right)$ has period π

asymptotes $x = \frac{(4k+1)\pi}{4}$

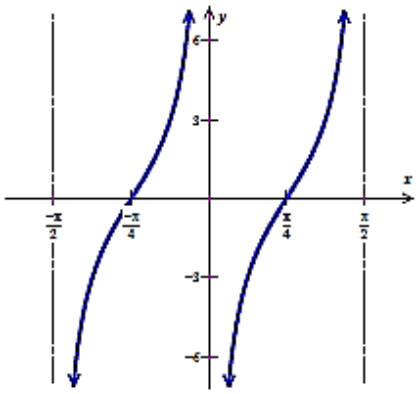
for integers k

15.

$f(x) = -3\cot(2x)$ has period $\frac{\pi}{2}$

asymptotes $x = \frac{k\pi}{2}$

for integers k



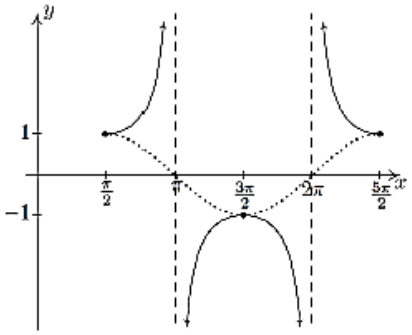
17. $f(x) = \tan\left[2\left(x - \frac{\pi}{8}\right)\right]$

19. (Solution not provided.)

Chapter 3.4

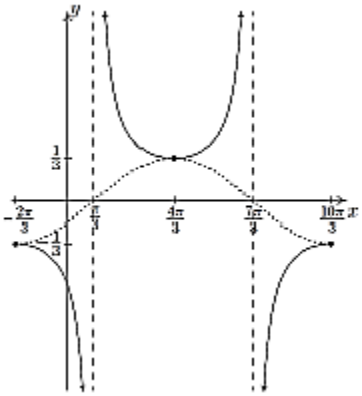
1.

$y = \sec\left(x - \frac{\pi}{2}\right)$ has period 2π



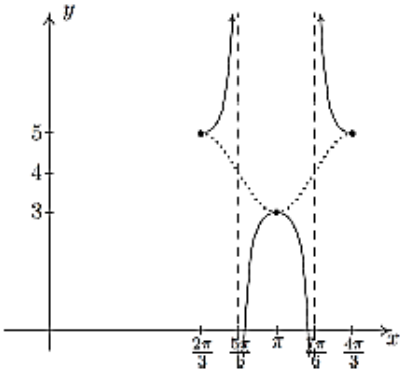
3.

$y = -\frac{1}{3}\sec\left(\frac{1}{2}x + \frac{\pi}{3}\right)$ has period 4π



5.

$y = \sec(3x - 2\pi) + 4$ has period $\frac{2\pi}{3}$

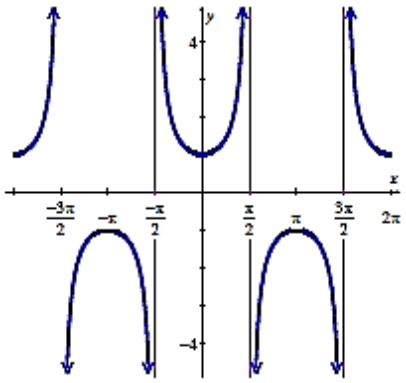


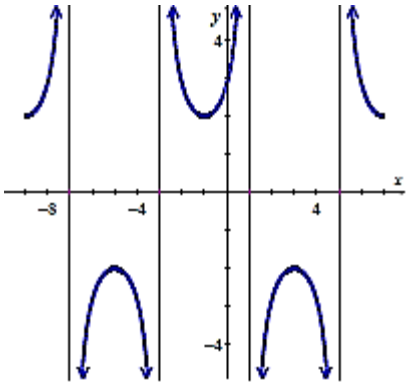
7.

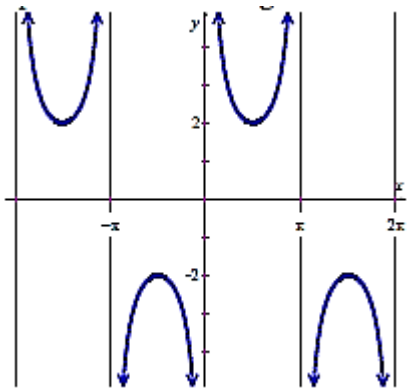
$f(x) = \sec(x)$ has period 2π

asymptotes $x = \frac{\pi}{2} + \pi k$ for integers k

9.







$f(x) = 2\sec\left(\frac{\pi}{4}(x+1)\right)$ has period 8

asymptotes $x = 1 + 4k$ for integers k

11.

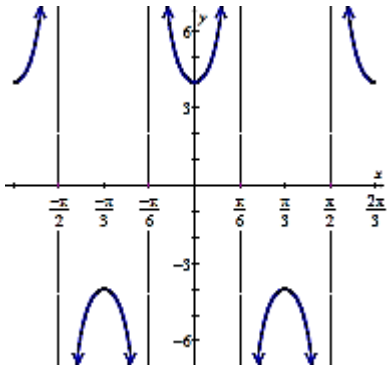
$f(x) = 2\csc(x)$ has period 2π

asymptotes $x = \pi k$ for integers k

13.

$f(x) = 4\sec(3x)$ has period $\frac{2\pi}{3}$

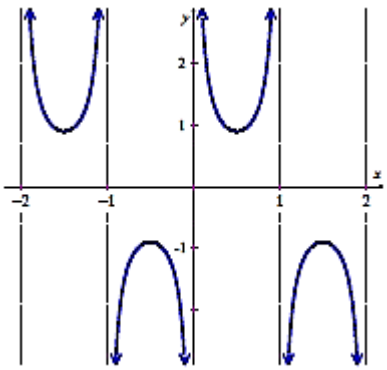
asymptotes $x = \frac{\pi}{6} + \frac{\pi}{3}k$ for integers k



15.

$f(x) = \frac{9}{10}\csc(\pi x)$ has period 2

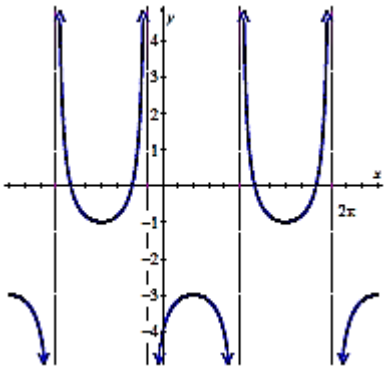
asymptotes $x = k$ for integers k



17.

$f(x) = -\sec\left(x - \frac{\pi}{3}\right) - 3$ has period 2π

asymptotes $x = \frac{5\pi}{6} + \pi k$ for integers k



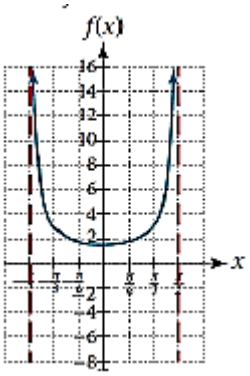
19. $f(x) = \csc(2x)$

21. $f(x) = 2\csc(x)$

23.

a. $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

b.



c. $x = -\frac{\pi}{2}$ and $x = \frac{\pi}{2}$

d.

$d\left(-\frac{\pi}{3}\right) = 3$ km is the distance

to the boat when $x = -\frac{\pi}{3}$

e. when $x = \frac{\pi}{6}$, the boat is about

1.73 km away

f. minimum distance is 1.52 km,

when $x = 0$